Washington State Department of Transportation

MEMORANDUM

April 6, 2006

TO: R. Stoddard/R. Zeldenrust
Bridge and Structures, 47340

FROM: Tony Allen/William Hegge
E&EP Geotechnical Division, MS 47365

SUBJECT: SR-305, OL-3420, Poulsbo to Bond Road Widening Project
Geotechnical Recommendations for Retaining Walls 17, 18 and 20

INTRODUCTION

This memorandum presents geotechnical recommendations for the design of Retaining Walls 17, 18 and 20 associated with the subject project. This project will widen SR-305 in from Poulsbo to Bond Road in Kitsap County, Washington, as shown on the Vicinity Map, Figure 1, Appendix A. We understand that the proposed project consists of widening SR 305 and some of the intersecting streets and improving the intersections with those streets. The proposed project has already been the subject of three geotechnical reports, referenced below:

> *"Geotechnical Report, SR 305 Improvements Project, SCL of Poulsbo to Bond Road, Poulsbo, Washington"* prepared by HWA Geosciences Inc. and dated May 23, 2001.
>
> *"Geotechnical Engineering Services, SR 305 – Poulsbo SCL to Bond Road, OL-3420, Poulsbo, Washington"* prepared by GeoEngineers Inc. and dated September 27, 2005
>
> *"SR-305, OL-3420, Bond Road to Poulsbo Widening Project OL-3420, Geotechnical Recommendations for Over-Excavation Quantities"* prepared by WSDOT E&EP Geotechnical Division and dated November 30, 2005.

RETAINING WALL DESCRIPTIONS

Since the time the above referenced reports were prepared, the final project design has resulted additional retaining walls along the project alignment. This study addresses the construction of three of these additional retaining walls on the project designated Retaining Walls 17, 18 and 20 as shown on Figure 2 in Appendix A. These retaining walls are described in Table 1 below:

Table 1 - Additional Retaining Walls

Retaining Wall	State Route	Initial Station	Initial Offset (ft)	Final Station	Final Offset (ft)	Maximum Wall Height (ft)	Proposed Wall Type
17	307	55+90	71.0 Lt	56+75	58.5 Lt.	6	MSE
18	305	783+15	49.0 Lt	784+75	49.0 Lt	6	MSE
20	307	51+00	31.0 Lt	51+75	31.0 Lt	6	Concrete Cantilever

Plan and profile views of the proposed retaining walls addressed in this memorandum are shown in Figure 3 through 5 in Appendix A.

FIELD EXPLORATIONS AND LABORATORY TESTING

To characterize the surface and subsurface conditions, we performed a site reconnaissance and drilled test borings at the site of each proposed retaining wall location. The test boring at the site of proposed Retaining Wall 17 was designated TH-48-05. The test borings at the site of proposed Retaining Wall 18 were designated TH-49-05 and TH-50-05. The test boring at the site of proposed Retaining Wall 20 was designated TH-47-05. The locations of these test borings are shown on Figures 3 through 5 in Appendix A. Boring logs and a legend of the terms and symbols used or shown on the boring logs are included in Appendix B.

Soil samples were obtained during drilling using a SPT (Standard Penetration Test) sampler. The number of blows required to achieve the final 12 inches of penetration was recorded as the soil's SPT resistance, or N-value, to assist in determining soil strength properties. Collected soil samples were returned to our laboratory for further testing and evaluation. Laboratory tests were performed for moisture content, grain size analyses and plasticity characteristics (Atterburg Limits).

SITE CONDITIONS

Site Topography, Regional Geology and Regional Seismicity

The above referenced reports provide detailed descriptions of the site topography, regional geology and regional seismicity. Therefore, we recommend that the discussions of site topography, regional geology and regional seismicity presented in the 2005 GeoEngineers Inc. report referenced above be used for the additional retaining walls on the project addressed in this report.

Local Geology

We reviewed the following geologic map for the project vicinity.

"Geologic Map of the Surficial Deposits in the Seattle 30' x 60' Quadrangle, Washington." This map was compiled by James C. Yount, James P. Minard and Glenn R. Dembroff and dated 1993.

This map shows that the portion of the project site in which these proposed retaining walls are located is in an area of Alluvium underlain by Vashon Till and Vashon Recessional Outwash. The alluvium is described as ranging from clay to gravel and organic rich. The Vashon Till is described as a very stiff and impermeable nonsorted, nonstratified mixture of clay, silt, gravel and boulders. The Vashon Recessional Outwash is described as poorly to moderately sorted and stratified gravel and sand with minor amounts of silt and clay. Where present, the Vashon Recessional Outwash generally overlies the Vashon Till and Underlies the Alluvium.

Subsurface Materials

The subsurface conditions observed in the borings made for the additional retaining walls on the project addressed in this report are in general agreement with the geologic mapping and the subsurface conditions observed in the 2005 GeoEngineers Inc. report referenced above. The subsurface conditions in these borings are shown on the boring logs included in Appendix B. This appendix also includes a detailed discussion of the field exploration program. Boring logs presented herein should be made available to all prospective bidders and included in the contract documents. Appendix C provides a discussion of the laboratory testing program and applicable test results. The soil deposits encountered in the test borings are described in the following paragraphs:

Boring TH-47-05 was drilled near the alignment of proposed Retaining Wall 20. In test boring TH-47-05 we observed 2.5 feet of loose silty sand overlying 2.5 feet of medium dense silty sand overlying dense to very dense silty sand extending to a depth of 15 feet below the ground surface. Underlying this we observed hard clay extending to the base of the boring at a depth 31.5 feet below the ground surface. A generalized cross-section of proposed Retaining Wall 20 indicating soil units and depths encountered is shown on Figure 3.

Boring TH-48-05 was drilled near the alignment of proposed Retaining Wall 17. In test boring TH-48-05 we observed 6 feet of medium dense to dense silty gravel containing slabs of broken concrete and wood debris. Underlying this material is 6 feet of loose silty sand containing wood debris. Underlying this material is 3 feet of very dense poorly graded gravel extending to a depth of 15 feet below the ground surface. Underlying this material is 10 feet of very stiff to hard clay. Underlying this is medium dense to dense silt extending to the base of the boring at a depth 31.5 feet below the ground surface. A generalized cross-section of proposed Retaining Wall 17 indicating soil units and depths encountered is shown on Figure 4.

Borings TH-49-05 and TH-50-05 were drilled near the alignment of proposed Retaining Wall 18. In both test borings we observed very dense silty sand beginning at the first samples taken at a depth of 3 feet below the ground surface. In test boring TH-49-05 this

very dense silty sand extended to a depth of 16 feet below the ground surface and was underlain by 2.5 feet of very dense silt which is underlain in turn by very stiff clay extending to the base of the boring at a depth of 30 feet below the ground surface. In test boring TH-50-05 this very dense silty sand extended to a depth of 23 feet below the ground surface and was underlain by hard clay extending to the base of the boring at a depth of 29.5 feet below the ground surface. A generalized cross-section of proposed Retaining Wall 18 indicating soil units and depths encountered is shown on Figure 5.

Groundwater

Water was measured in all four of the borings made for these additional retaining walls at the time of drilling. In addition, piezometers were installed in TH-47-05 and TH-49-05-05 to permit ground water level measurements at later times. The groundwater levels observed in the borings are presented in Table 2 below:

Table 2 – Ground Water Levels

Boring	Date	Depth to Ground Water (ft)	Elevation of Ground Water (ft, msl)
TH-47-05	11/17/05*	1.9	29.1
"	12/2/05	3.4	27.6
TH-48-05	11/18/05*	4.7	28.3
TH-49-05	11/30/05*	2.8	29.5
"	12/2/05	2.4	29.9
TH-50-05	11/29/05*	4.0	27.8

*This groundwater level measurement obtained at time of drilling.

In addition to measuring the groundwater levels at time of drilling, the boreholes were bailed and allowed to recharge. The depth of bailing and the amount and time of the recharge are presented in the Table 3 below:

Table 3 – Ground Water Recharge Rate Data

Boring	Initial Depth to Ground Water After Drilling (ft)	Depth of Bailing of Ground Water (ft)	Recharged Depth to Ground Water (ft)	Time Duration of Recharge (Minutes)
TH-47-05	8.0	20.0	2.0	20
TH-48-05	4.0	18.0	4.7	15
TH-49-05	Unknown*	20.0	3.0	10
TH-50-05	Unknown*	20.0	4.0	20

*Groundwater level prior to bailing not recorded.

SEISMOLOGICAL CONSIDERATIONS

Design Earthquake Parameters

For seismic design, a peak ground acceleration coefficient of 0.32 is recommended, based on the Bridge Design Manual. The recommended acceleration coefficient is based on an expected ground motion at the project site that has a 10 percent probability of exceedance in a 50-year period (475-year return period).

Ground Fault Rupture

The closest mapped fault to the project site is located approximately 10 miles to the southeast. Therefore, the risk of ground rupture at this site is considered low.

Liquefaction Potential

The liquefaction potential of saturated soils is evaluated mainly on soil gradation, density, and the depth of the deposit. The potential for liquefaction is highest for loose, fine to medium grained sands and silty sands. Increasing fines content (i.e., silt and clay) decreases the potential for liquefaction. Conversely, clean coarse grained granular soils are less susceptible to liquefaction due to their high permeability. The potential for liquefaction also decreases with increasing density and depth.

We have evaluated the potential for liquefaction of the project soils based on the SPT data obtained from the field explorations and the percentages of silt. The subsurface conditions observed in the explorations for the proposed retaining walls discussed in this report generally consist of medium dense to very dense silts, sands and gravels and very stiff to hard clays. Our analyses show that this material is not susceptible to liquefaction.

GEOTECHNICAL RECOMMENDATIONS

Retaining Wall 17

Proposed Retaining Wall 17 is being designed as a proprietary structural earth wall with a welded wire face. Our analysis indicates that the anticipated settlements are expected to be on the order of one inch or less. However, the retaining wall is being constructed in an area of fill containing concrete and wood debris. Due to site constraints (proposed Retaining Wall 17 is located outside WSDOT right of way) we were unable to dig test pits or drill additional borings along the length of this proposed retaining wall. Therefore, we are uncertain about the nature and distribution of fill beneath the proposed retaining wall. Because of this, actual settlements may be larger than calculated and the differential settlement may be as large as the total settlement. To reduce the potential for differential settlement, we recommend 2 feet of overexcavation and replacement of the soils beneath the proposed retaining wall. The need for this should be revaluated in the construction

stage when the subgrade for Retaining Wall 17 is excavated. The Design parameters for inclusion in General Special Provision, titled *Structural Earth Walls*, (GSP 13030201.FB6), are provided as follows:

Soil Parameters	Retaining Wall Backfill	Retained Soil	Foundation Soil
Unit Weight (pcf)	125	125	125
Friction Angle (deg)	36	36	32
Cohesion (psf)	0	0	0

Foundation Soil	AASHTO Load Group I	AASHTO Load Group VII
Allowable Bearing Capacity (tsf)	3	10
Acceleration Coefficient (g)	0	0.32

Retaining Wall 18

Proposed Retaining Wall 18 is being designed as a proprietary structural earth wall with a welded wire face. Our analysis indicates that the anticipated settlements are expected to be on the order of one inch or less. Due to the presence of a drainage swale in front of the retaining wall, we recommend that the base of the retaining wall be 2 feet below the base of the drainage swale. Design parameters for inclusion in General Special Provision, titled *Structural Earth Walls*, (GSP 13030201.FB6), are provided as follows:

Soil Parameters	Retaining Wall Backfill	Retained Soil	Foundation Soil
Unit Weight (pcf)	125	125	135
Friction Angle (deg)	36	36	38
Cohesion (psf)	0	0	0

Foundation Soil	AASHTO Load Group I	AASHTO Load Group VII
Allowable Bearing Capacity (tsf)	4	10
Acceleration Coefficient (g)	0	0.32

General notes for proposed Retaining Walls 17 and 18 are as follows:

1. A traffic surcharge of 250 psf should be added when designing the retaining walls.

2. The SE wall system should meet the following requirements.

   - The wall should be placed on a level (in direction perpendicular to the wall face) and firm foundation. Walls can be allowed to slope along their length up to 6H:1V (horizontal:vertical) or stepped if a steeper wall base is needed.

   - Wall face batter should be no steeper than 1H:48V.

- The base width of the wall should be greater than or equal to 70 percent.
- The top reinforcing layer should be placed no lower than 2 feet below the top of the wall.
- Wall embedment should be at least 2 feet or 10 percent of the wall height, whichever is greater.
- Provisions for permanent control of subsurface water behind the wall should consist of a slotted drain pipe embedded in Gravel Backfill for Drains (Section 9-03.12(4)).
- Drainage structures should be located outside the reinforced zone where possible. If drainage structures are planned within the reinforced zone, they must be shown on the plans and profile sheets provided to the wall proprietor so they can account for the structures in their design. If drainage structures are located behind the face of a MSE wall, the outfall pipe should run perpendicular to the wall face.

Retaining Wall 20

We understand that both a structural earth wall and a concrete cantilever wall were considered for Retaining Wall 20. However, the desire to reduce impacts upon the adjacent roadway from construction excavations has made a concrete cantilever wall the preferred option for this retaining wall. Based upon the conditions observed in our subsurface explorations in the vicinity of proposed retaining wall 20, Standard Plans D-1a and D-1b (concrete cantilever walls) may be used for this retaining wall. This retaining wall should be founded at or below elevation 28.0 feet and backfilled in accordance with Standard Plan D-4. Our analysis indicates that the anticipated settlements are expected to be on the order of one inch or less for design bearing stresses of less than 2000 psf.

Prior to contract advertisement, the Project office should contact each of the wall proprietors listed in the General Special Provisions to confirm that they want to be included in the contract.

CONSTRUCTION CONSIDERATIONS

Temporary Cut Slopes

Temporary cuts to install the retaining walls and retaining wall reinforcing (where applicable) may impact the existing roadway. We recommend the use of temporary cut slopes equal to or less than 1H:1V (Horizontal:Vertical). If seepage or sloughing on the temporary cut slopes is observed, it may be necessary to flatten these cut slopes.

Surface Water Control

Surface water is present in the near vicinity of all of these proposed additional retaining walls. This surface water will have to be controlled and directed away from the excavations

for the construction of the retaining walls. Because of the need to control surface water, it is desirable to schedule construction of these retaining walls in the drier summer months when surface water flows are expected to be less.

Over-Excavation and Replacement of Unsuitable Soils

The above referenced 2005 GeoEngineers Inc. report did not make any recommendations regarding over-excavation and replacement of unsuitable soils along the length of the proposed retaining walls. The above referenced 2005 WSDOT E&EP Geotechnical Division Memorandum was prepared to correct this deficiency. However, at the time of that memorandum, all of the subsurface information for proposed Retaining Walls 17, 18 and 20 were not available. The recommendation for over-excavation and replacement of unsuitable soils along the length of these proposed retaining walls was as follows:

> "We anticipate localized over-excavation and replacement of unsuitable soils along the alignment of these proposed retaining walls to provide adequate bearing for these retaining walls. We recommend that the quantity of over-excavation and replacement of unsuitable soils along the alignment of these proposed retaining walls be calculated by assuming 2 feet of over-excavation and replacement of unsuitable soils along 15 percent of the length of these retaining walls."

Based upon the results of our field investigation and engineering analyses, this recommendation is correct for proposed Retaining Wall 20. However, this recommendation is not correct for proposed Retaining Walls 17 and 18. Based upon the results of our field investigation and engineering analyses, we recommend that the quantity of over-excavation and replacement of unsuitable soils along the alignment of proposed Retaining Wall 17 be calculated by assuming 2 feet of over-excavation and replacement of unsuitable soils along the entire length of proposed Retaining Wall 17. The need for this should be revaluated in the construction stage when the subgrade for Retaining Wall 17 is excavated. In addition, we recommend a zero quantity of over-excavation and replacement of unsuitable soils along the entire length of proposed Retaining Wall 18.

Traffic Control

All of the proposed retaining walls will be constructed in the vicinity of other proposed retaining walls to be constructed as part of this project. Some of this construction may reduce traffic on the site roads to one lane traffic. These constrictions, especially in the vicinity of intersections, may result in significant traffic impacts. Consideration should be given to the scheduling of the retaining wall construction, whether it is preferable to have lower impacts for al longer period of time or greater impacts for a lesser period of time.

INTENDED MEMORANDUM USE AND LIMITATIONS

This memorandum has been prepared to assist the Washington State Department of Transportation in the engineering design and construction of the subject project. It should not

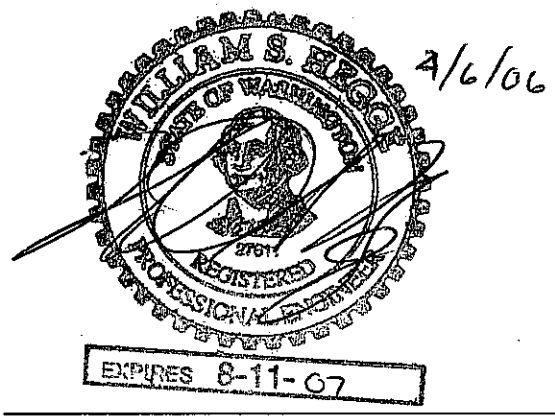
be used, in part or in whole for other purposes without contacting the E&EP Geotechnical Division for a review of the applicability of such reuse. This report should be made available to prospective contractors for their information or factual data only and not as a warranty of ground conditions.

The conclusions and recommendations contained in this report are based on the Geotechnical Division's understanding of the project at the time that the report was written and on site conditions that existed at time of the field exploration. If significant changes to the nature, configuration, or scope of the project occur during the design process, the Geotechnical Division should be consulted to determine the impact of such changes on the recommendations and conclusions presented in this report.

Site exploration and testing describes subsurface conditions only at the sites of subsurface exploration and at the intervals where samples are collected. These data are interpreted by members of the Geotechnical Division who then render an opinion regarding the general subsurface conditions. The distribution, continuity, thickness, and characteristics of identified (and unidentified) subsurface materials may vary considerably from that indicated by the subsurface data. While nothing can be done to prevent such variability, the Geotechnical Division is prepared to work with the Design Team to reduce the impacts of variability on project design, construction, and performance. Periodic geotechnical observation during construction may be beneficial in this respect. This ongoing involvement of the Geotechnical Division throughout the design and project development process will also help to avoid costly mistakes associated with misinterpretation of the contents of this report and resulting shortcomings of project design or contract documents.

The conclusions and recommendations presented in this report assume that surface and subsurface conditions, as observed during field exploration activities are representative of the site conditions throughout the project area. Because of this assumption, these recommendations should be considered subject to change depending on actual subsurface conditions encountered. Actual subsurface conditions can be discovered only during earthwork and construction operations. Accordingly, the Geotechnical Division should be involved in the construction of the project in order to make appropriate observations and recommendations for alteration in design, as appropriate.

If you have questions or require further information, please contact William Hegge at (360) 709-5415.



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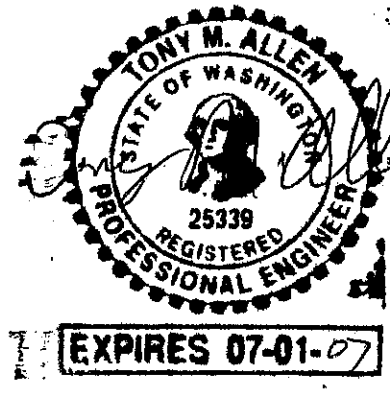
Prepared By:
William S. Hegge
Senior Foundation Engineer



4/6/06

Agency Approval Authority:
Tony M. Allen
State Geotechnical Engineer

TMA: wsh

cc:

Mel Hitzke, Olympic Region Materials Engineer, MS 47440

Craig Boone, EESC Bridge and Structures, MS 47340

APPENDIX A - FIGURES

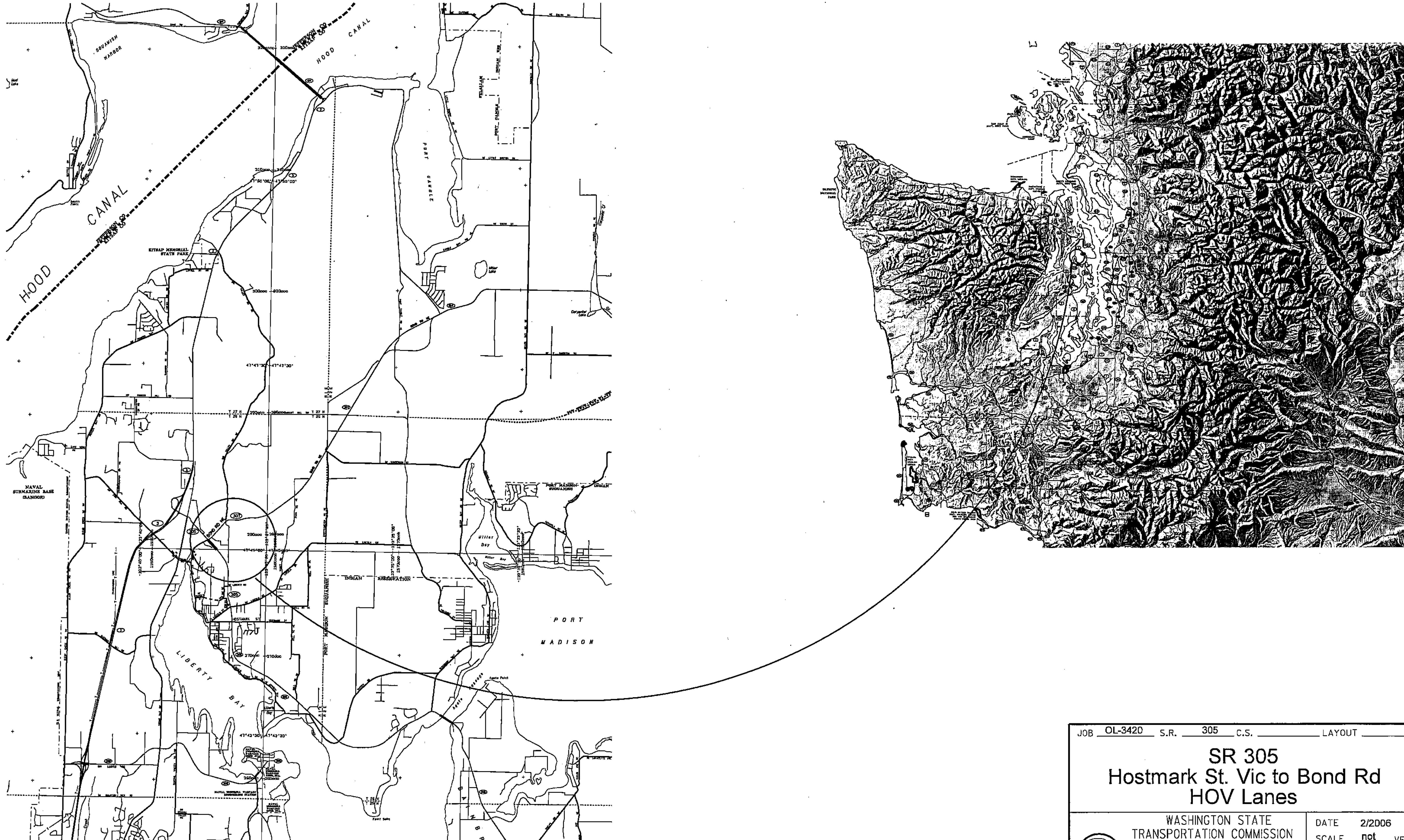


Figure 1: Vicinity Map

JOB OL-3420 S.R. 305 C.S. ______ LAYOUT ______

SR 305
Hostmark St. Vic to Bond Rd
HOV Lanes

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH
R. G. FINKLE MATERIALS ENGINEER

DATE 2/2006
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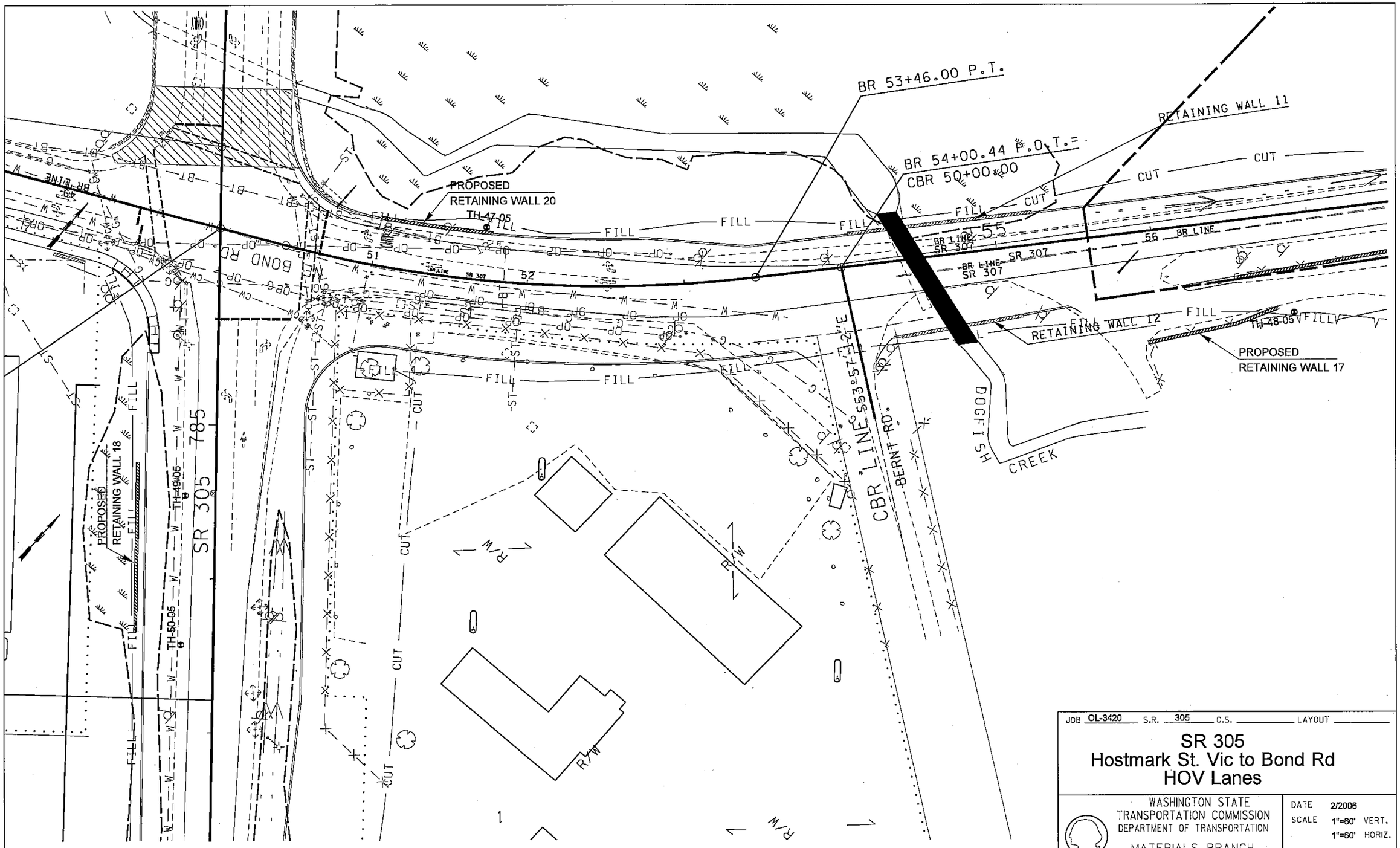

Figure 2: Site Plan

JOB OL-3420 S.R. 305 C.S. _____ LAYOUT _____

SR 305
Hostmark St. Vic to Bond Rd
HOV Lanes

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 2/2006
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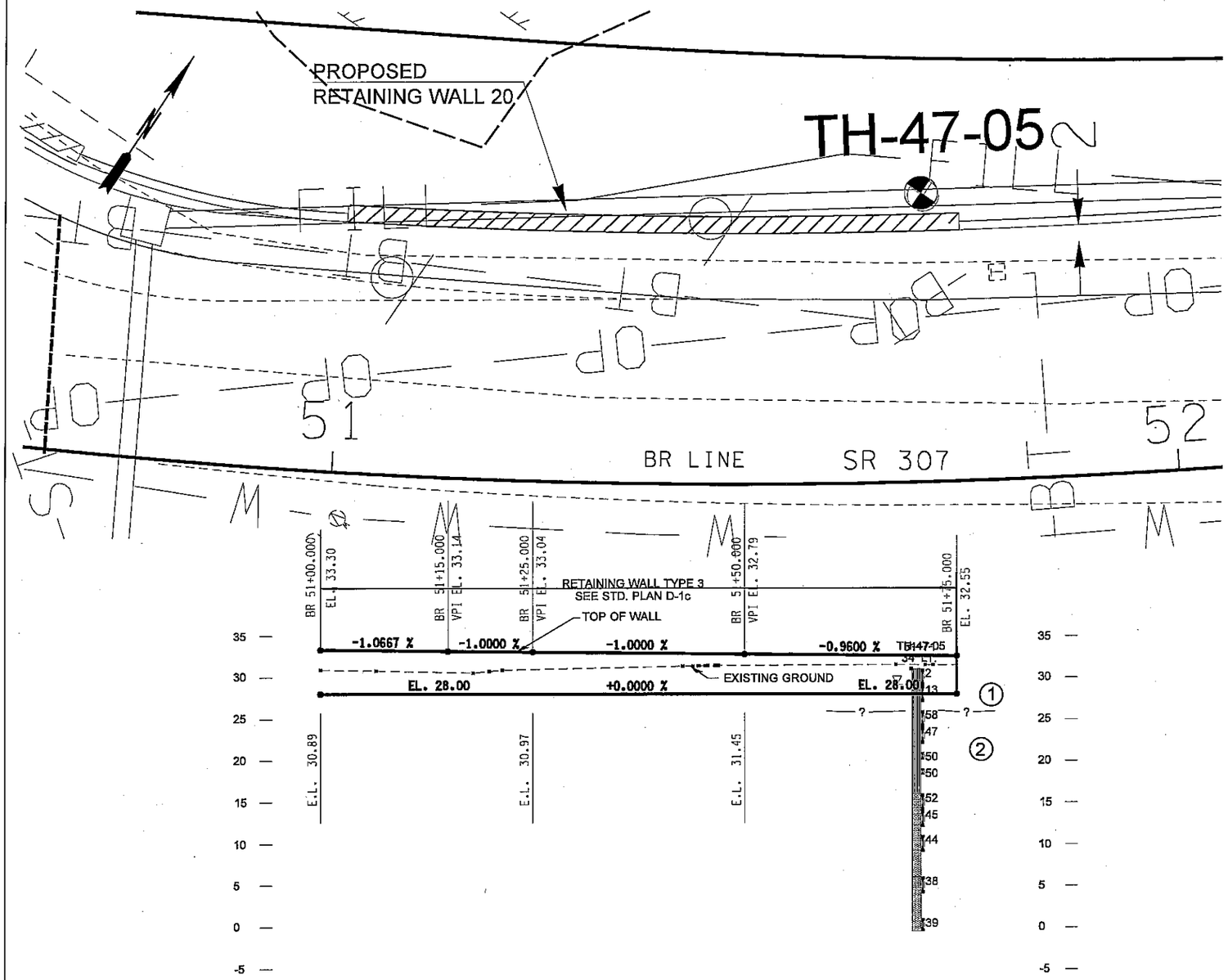

① Loose to medium dense silty SAND

② Dense to very dense silty SAND

Figure 3: Proposed Retaining Wall 20 Plan and Profile views

JOB OL-3420 S.R. 305 C.S. _____ LAYOUT _____

SR 305
Hostmark St. Vic to Bond Rd
HOV Lanes

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

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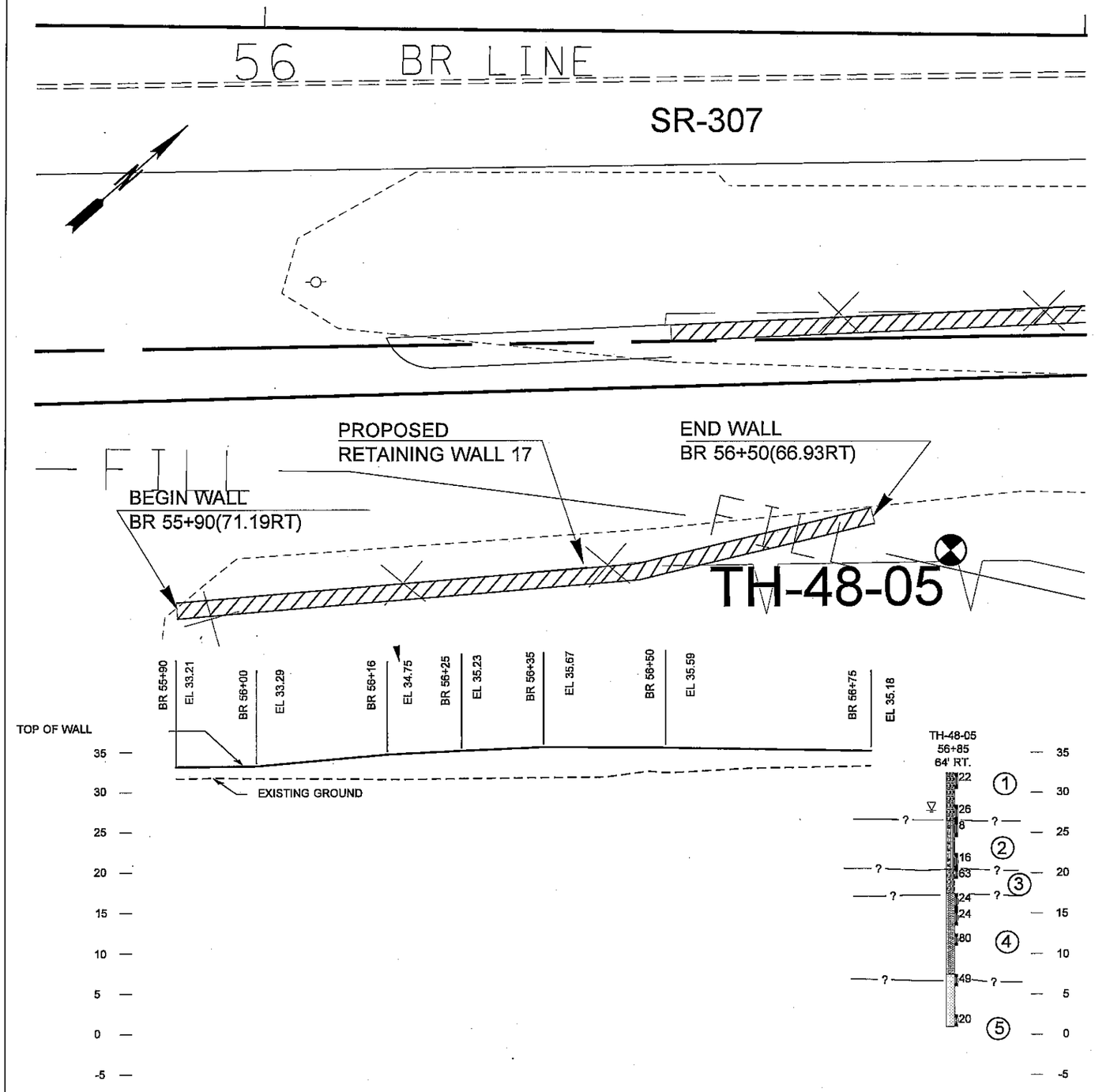

① Medium dense to dense, silty SAND with concrete fragments and wood debris (fill)

② Loose silty SAND with wood debris

③ Poorly graded GRAVEL with silt and sand

④ Very stiff to hard CLAY

⑤ Medium dense to dense SILT

Figure 4: Proposed Retaining Wall 17 Plan and Profile views

JOB OL-3420 S.R. 305 C.S. _____ LAYOUT _____

SR 305
Hostmark St. Vic to Bond Rd
HOV Lanes

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MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

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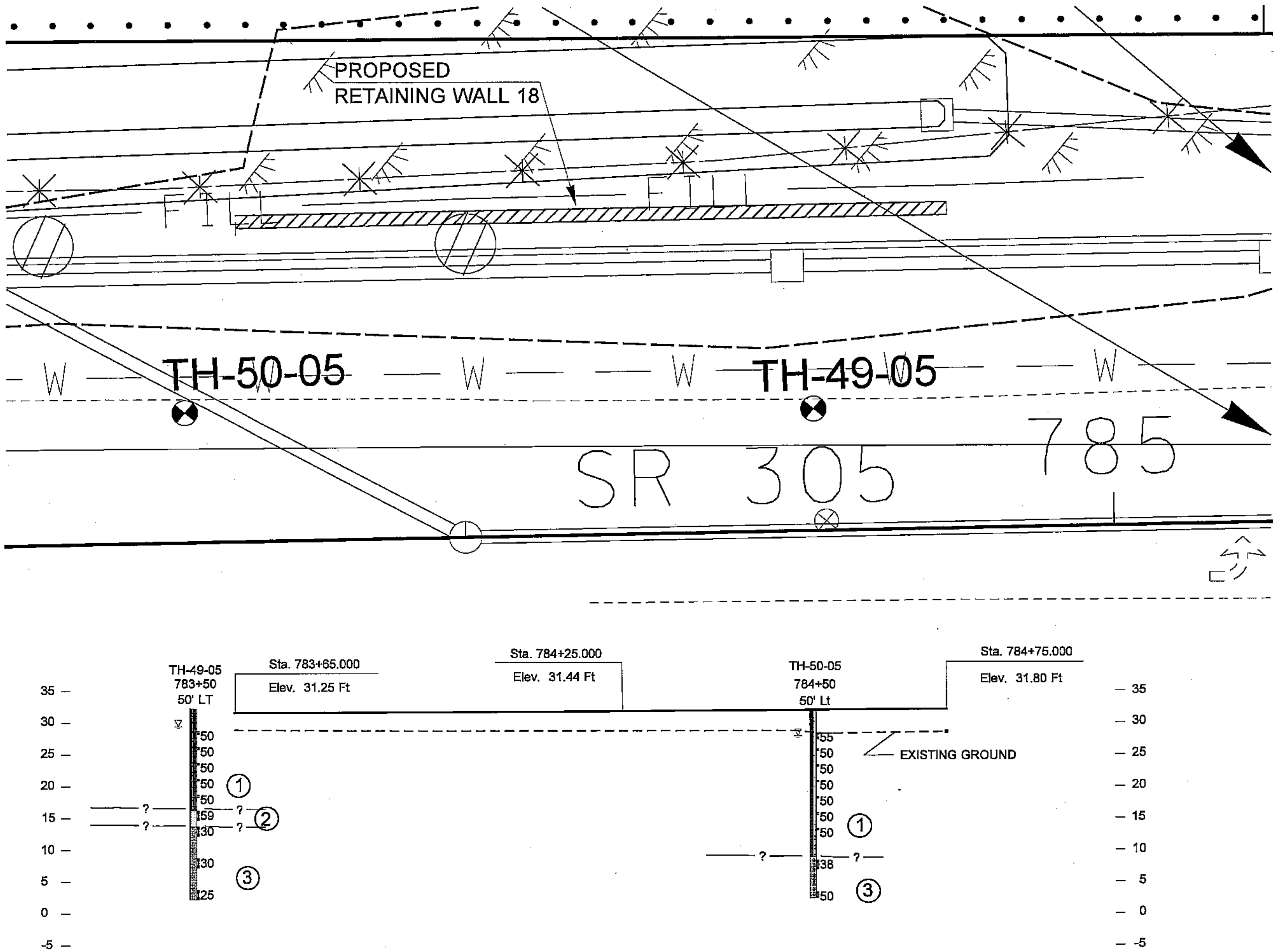

① Very dense silty SAND

② Very dense SILT

③ Very stiff to hard CLAY

JOB OL-3420 S.R. 305 C.S. LAYOUT

SR 305
Hostmark St. Vic to Bond Rd
HOV Lanes

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 12/2005
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Figure 5: Proposed Retaining Wall 18 Plan and Profile views

APPENDIX B - FIELD EXPLORATION

FIELD EXPLORATION

The field exploration program for the project consisted of drilling three exploratory borings, designated TH-47-05 through TH-50-05. Logs of the test borings are attached and should be included in the contract documents.

TH-47-05 and TH-48-05 were performed using a skid mounted CME 45 drill rig. TH-49-05 and TH-50-05 were performed using a using a BK81 truck-mounted drilling rig. The borings were advanced using wet rotary drilling methods to the depths and elevations described above. Soil samples were obtained during drilling using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM D-1586. The SPTs were obtained by driving a 2-inch outside diameter split-spoon sample 18-inches into the soil with a 140-pound hammer. The number of blows required to achieve each 6 inches of penetration was recorded and the soil's SPT resistance, or N-value, was calculated as the number of blows required to achieve the final 12 inches of penetration. The skid-mounted drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammer is rated at approximately 70 percent efficiency, as compared to approximately 60 percent for manual hammers.

Select soil samples were then submitted to the OSC Materials Laboratory for laboratory testing.

Washington State Department of Transportation

Test Boring Legend

Grain Size

Fine Grained	< 1mm	Few crystal boundaries/grains are distinguishable in the field or with hand lens.
Medium Grained	1mm to 5mm	Most crystal boundaries/grains are distinguishable with the aid of a hand lens.
Coarse Grained	> 5mm	Most crystal boundaries/grains are distinguishable with the naked eye.

Weathered State

Term	Description	Grade
Fresh	No visible sign of rock material weathering; perhaps slight discoloration in major discontinuity surfaces.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than its fresh condition.	II
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a continuous framework or as core stones.	III
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as discontinuous framework or as core stone.	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	V
Residual Soil	All rock material is converted to soil. The mass structure and material fabric is destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI

Relative Rock Strength

Grade	Description	Field Identification	Uniaxial Compressive Strength approx
R1	Very Weak	Specimen crumbles under sharp blow from point of geological hammer, and can be cut with a pocket knife.	1 to 25 MPa
R2	Moderately Weak	Shallow cuts or scrapes can be made in a specimen with a pocket knife. Geological hammer point indents deeply with firm blow.	25 to 50 MPa
R3	Moderately Strong	Specimen cannot be scraped or cut with a pocket knife, shallow indentation can be made under firm blows from a hammer.	50 to 100 MPa
R4	Strong	Specimen breaks with one firm blow from the hammer end of a geological hammer.	100 to 200 MPa
R5	Very Strong	Specimen requires many blows of a geological hammer to break intact sample.	Greater than 200 MPa

Discontinuities

Spacing

Very Widely	Greater than 3 m
Widely	1 m to 3 m
Moderately	0.3 m to 1 m
Closely	50 mm to 300 mm
Very Closely	Less than 50 mm

RQD (%)

$$\frac{100(\text{length of core in pieces} > 100\text{mm})}{\text{Length of core run}}$$

Condition

Excellent	Very rough surfaces, no separation, hard discontinuity wall
Good	Slightly rough surfaces, separation less than 1 mm, hard discontinuity wall.
Fair	Slightly rough surfaces, separation greater than 1 mm, soft discontinuity wall.
Poor	Slickensided surfaces, or soft gouge less than 5 mm thick, or open discontinuities 1 to 5 mm.
Very Poor	Soft gouge greater than 5 mm thick, or open discontinuities greater than 5 mm.

Fracture Frequency (FF) is the average number of fractures per 300 mm of core.
Does not include mechanical breaks caused by drilling or handling.

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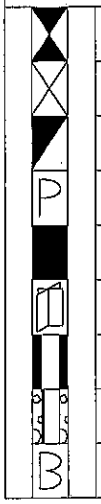
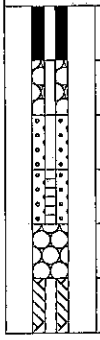
Test Boring Legend

Sampler Symbols



Standard Penetration Test
Oversized Penetration Test (Dames & Moore, California)
Shelby Tube
Piston Sample
Washington Undisturbed
Vane Shear Test
Core
Becker Hammer
Bag Sample

Well Symbols



Cement Surface Seal
Piezometer Pipe in Granular Bentonite Seal
Piezometer Pipe in Sand
Well Screen in Sand
Granular Bentonite Bottom Seal
Inclinometer Casing in Concrete Bentonite Grout

Laboratory Testing Codes

UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
UC	Unconfined Compression Test
DS	Direct Shear Test
CN	Consolidation Test
GS	Grain Size Distribution
MC	Moisture Content
SG	Specific Gravity
OR	Organic Content
DN	Density
AL	Atterberg Limits
PT	Point Load Compressive Test
SL	Slake Test
DG	Degradation
LA	LA Abrasion
HT	Hydrometer Test

Soil Density Modifiers

Gravel, Sand & Non-plastic Silt		Elastic Silts and Clay	
SPT Blows/ft	Density	SPT Blows/ft	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-24	Medium Dense	5-8	Medium Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

Angularity of Gravel & Cobbles

Angular	Coarse particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Coarse grained particles are similar to angular but have rounded edges.
Subrounded	Coarse grained particles have nearly plane sides but have well rounded corners and edges.
Rounded	Coarse grained particles have smoothly curved sides and no edges.

Soil Moisture Modifiers

Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

Soil Structure

Stratified	Alternating layers of varying material or color at least 6mm thick; note thickness and inclination.
Laminated	Alternating layers of varying material or color less than 6mm thick; note thickness and inclination.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, somtimes striated.
Blocky	Cohesive soil that can be broken down into smaller angular lumps which resist further breakdown.
Disrupted	Soil structure is broken and mixed. Infers that material has moved substantially - landslide debris.
Homogeneous	Same color and appearance throughout.

HCL Reaction

No HCL Reaction	No visible reaction.
Weak HCL Reaction	Some reaction with bubbles forming slowly.
Strong HCL Reaction	Violent reaction with bubbles forming imediately.

Degree of Vesicularity of Pyroclastic Rocks

Slightly Vesicular	5 to 10 percent of total
Moderately Vesicular	10 to 25 percent of total
Highly Vesicular	25 to 50 percent of total
Scoriaceous	Greater than 50 percent of total

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-68311

HOLE No. TH-47-05

Sheet 1 of 2

Job No. OL-3420 SR 305 Elevation 31.0 ft (9.4 m)

Project SR-305 Widening Bond Road to Poulsbo Driller Kerry Cooper Lic# 2552

Site Address Vicinity SR-307 and SR-305 Inspector Cleo Andrews

Start November 17, 2005 Completion November 17, 2005 Well ID# AHN-872 Equipment CME 45 w/ autohammer

Station 51+35 Offset 30.0' LT. Casing 3" ID x 35.0' Method Wet Rotary

Northing _____ Easting _____ Latitude _____ Longitude _____

County Kitsap Subsection SE-SW Section 11 Range 1 EWM Township 26 N

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			4 1 1 1 (2)		D-1		Silty SAND with gravel, organic soil and wood fragments, very loose, dark brown, moist, Stratified, HCl reaction not tested. Length Recovered 0.5 ft, Length Retained 0.5 ft		
			3 3 10 20 (13)		D-2	GS MC	11/17/2005 SM, M.C. = 20% Silty SAND with gravel, medium dense, grayish brown, moist, Stratified with poorly graded SAND with organic soil, wood fragments and root hairs, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
5	1	>>	22 30 28 29 (58)		D-3	GS MC	12/02/2005 SM, M.C. = 13% Silty SAND with gravel, laminated with with fine grained sand lenses, very dense, brown, wet, Stratified, HCl reaction not tested, trace of organic soil and brownish orange staining. Length Recovered 2.0 ft, Length Retained 1.5 ft		
	2		26 19 28 45 (47)		D-4		Silty SAND with gravel, dense, brown, wet, laminated, HCl reaction not tested, trace of brownish orange staining Length Recovered 1.8 ft, Length Retained 1.0 ft		
10	3		26 50/5" (50/5")		D-5	GS MC	SM, M.C. = 15% Silty SAND, with layer of well graded gravel with sand, from 10.0 to 10.3', very dense, gray, wet, Stratified, HCl reaction not tested. Length Recovered 0.9 ft, Length Retained 0.9 ft		
	4		42 50/3" (50/3")		D-6		Silty Sand, very dense, grayish brown to gray, wet, Stratified, HCl reaction not tested. Length Recovered 0.7 ft, Length Retained 0.7 ft		
15	5	>>	14 21 31 36 (52)		D-7		Lean CLAY, hard, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
			10 15 30 36 (45)		D-8	GS MC AL	CL, M.C. = 22%, PI = 24 Lean CLAY, hard, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
20	6								

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 1:39:41 P2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-68311

HOLE No. TH-47-05

Sheet 2 of 2

Job No. OL-3420 SR 305 Elevation 31.0 ft (9.4 m)

Project SR-305 Widening Bond Road to Poulsbo Driller Kerry Cooper Lic# 2552

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				11 19 25 33 (44)		D-9		Lean CLAY, hard, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
25	7			15 15 23 25 (38)		D-10	GS MC AL	CH, M.C. = 24%, PI = 25 Fat CLAY, hard, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
30	8 9			9 16 13 (39)		D-11		Fat CLAY, hard, dark gray, moist, Homogeneous, HCl reaction not tested Length Recovered 1.5 ft, Length Retained 1.0 ft		
35	10 11							End of test hole boring at 31.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
40	12									
45	13									

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06,1:39:41 P2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22889

HOLE No. TH-48-05

Sheet 1 of 2

Job No. OL-3420 SR 305 Elevation 33.0 ft (10.1 m)

Project SR-305 Widening Bond Road to Poulsbo Driller Kerry Cooper Lic# 2552

Site Address Vicinity of SR-307 and SR-305 Inspector Cleo Andrews

Start November 17, 2005 Completion November 18, 2005 Well ID# Equipment CME 45 w/ autohammer

Station 56+25 Offset 70' RT. Casing 3" ID x 35.0' Method Wet Rotary

Northing Easting Latitude Longitude

County Kitsap Subsection SE-SW Section 11 Range 1 EWM Township 26 N

Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			1 4 18 36 (22)		D-1	GS MC	GM, MC=12% Silty GRAVEL with sand and root hairs, subrounded, medium dense, dark brown, moist, Stratified, HCl reaction not tested. Fragment of broken concrete encounted from 2.0 to 3.8 feet. Length Recovered 1.8 ft, Length Retained 1.0 ft		
5	1		10 12 14 8 (26)		D-2		11/18/2005 Silty GRAVEL with sand and wood fragments, subrounded, dense, grayish brown, moist, Stratified, HCl reaction not tested, (Fill). Length Recovered 0.5 ft, Length Retained 0.5 ft	▽	
	2		4 5 3 3 (8)		D-3	GS MC	SP-SM, MC=15% Poorly graded SAND with silt, gravel, and wood fragments, loose, grayish brown, wet, Stratified, HCl reaction not tested. Length Recovered 0.5 ft, Length Retained 0.5 ft		
10	3		6 5 11 23 (16)		D-4		Poorly graded SAND with silt, gravel, and wood fragments, medium dense, grayish brown, moist, Stratified, HCl reaction not tested. Length Recovered 0.5 ft, Length Retained 0.5 ft		
	4	>>	12 13 50/3 (63/9")		D-5	GS MC	GP-GM, MC=11% Poorly graded GRAVEL with silt and sand, very dense, medium dark gray, wet, Homogeneous, HCl reaction not tested. Gravel disappeared at 14.0' as indicated by drilling performance. Length Recovered 0.8 ft, Length Retained 0.8 ft		
15	5		5 9 15 17 (24)		D-6		Fat CLAY, very stiff, medium dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
			5 9 15 17 (24)		D-7	GS MC AL	CH, MC=27%, PI=25 Fat CLAY, very stiff, medium dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 2.0 ft, Length Retained 1.0 ft		
20	6	>>							

SOIL 0L-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 10:26:37 A2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22889

HOLE No. TH-48-05

Sheet 2 of 2

Job No. OL-3420 SR 305 Elevation 33.0 ft (10.1 m)

Project SR-305 Widening Bond Road to Poulsbo

Driller Kerry Cooper Lic# 2552

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				17 22 58 (80)		D-8		Fat CLAY, hard, medium dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.0 ft		
25	7			19 19 30 (49)		D-9	GS MC AL	ML, MC=26%, LL=33, PI=NP SILT, dense, medium dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.0 ft		
30	8 9			4 7 13 (20)		D-10		SILT, medium dense, dark gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.0 ft		
35	10 11							End of test hole boring at 31.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
40	12									
45	13									

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 10:26:37 A2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-68312

HOLE No. TH-49-05

Sheet 1 of 2

Job No. OL-3420 SR 305 Elevation 32.3 ft (9.9 m)

Project SR-305 Widening Bond Road to Poulsbo Driller Thomas Harvey Lic# 2599

Site Address Vic. SR-305 & SR-307 Inspector James Fetterly

Start November 30, 2005 Completion November 30, 2005 Well ID# AKK-374 Equipment CME 45 w/ autohammer

Station 783+50 Offset 50' LT Casing 4" x 35' Method Wet Rotary

Northing Easting Latitude Longitude

County Kitsap Subsection NW/NW Section 14 Range 1 EWM Township 26 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
									12/02/2005 11/30/2005	
	1			50/6" (50/6")		D-1	GS MC	SM, M.C. = 12% Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested, Asphalt thickness is 8". Length Recovered 0.5 ft, Length Retained 0.5 ft		
5										
	2			50/5" (50/5")		D-2		Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.4 ft, Length Retained 0.4 ft		
				50/3" (50/3")		D-3		Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
10	3									
				50/3" (50/3")		D-4	GS MC	SM, M.C. = 12% Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
	4			50/4" (50/4")		D-5		Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.4 ft, Length Retained 0.4 ft		
15										
	5		>>	16 31 28 (59)		D-6	GS MC	ML, M.C. = 22% SILT, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.3 ft, Length Retained 1.3 ft		
				8 14 16 (30)		D-7		Fat Clay, very stiff, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.3 ft, Length Retained 1.3 ft		
20	6									

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 10:26:40 A2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card R-68312

HOLE No. TH-49-05

Job No. OL-3420 SR 305 Elevation 32.3 ft (9.9 m)

Sheet 2 of 2

Project SR-305 Widening Bond Road to Poulsbo

Driller Thomas Harvey Lic# 2599

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
25	7			8 13 17 (30)		D-8	GS MC AL	CH, M.C. = 22%, PI = 25 Fat Clay, very stiff, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8									
30	9			8 11 14 (25)		D-9		Fat Clay, very stiff, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.5 ft		
								End of test hole boring at 30 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35	10									
	11									
40	12									
	13									
45										

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 10:25:41 A2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22888

HOLE No. TH-50-05

Sheet 1 of 2

Job No. OL-3420 SR 305 Elevation 31.8 ft (9.7 m)

Project SR-305 Widening Bond Road to Poulsbo

Driller Thomas Harvey Lic# 2599

Site Address Vic. SR-305 & SR-307

Inspector James Fetterly

Start November 29, 2005 Completion November 29, 2005 Well ID# Equipment CME 45 w/ autohammer

Station 784+50 Offset 50' Lt Casing 4" x 34' Method Wet Rotary

Northing Easting Latitude Longitude

County Kitsap Subsection NW/NW Section 14 Range 1 EWM Township 26 N

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1		>>	19 55 (55)		D-1	GS MC	SM, M.C. = 13% Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.8 ft, Length Retained 0.8 ft 11/29/2005	▽	
5				50/4" (50/4")		D-2	GS MC	SM, M.C. = 12% Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.4 ft, Length Retained 0.4 ft		
	2									
				50/3" (50/3")		D-3		Silty SAND, very dense, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
10	3			50/3" (50/3")		D-4		Silty SAND, very dense, gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
	4			50/3" (50/3")		D-5	GS MC	SM, M.C. = 12% Silty SAND, very dense, gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 0.3 ft, Length Retained 0.3 ft		
15	5			50/6" (50/6")		D-6		Silty SAND, very dense, gray, wet, Homogeneous, HCl reaction not tested. Length Recovered 0.5 ft, Length Retained 0.5 ft		
	6			50/3" (50/3")		D-7		Silty SAND, very dense, gray, wet, Homogeneous, HCl reaction not tested. Sand disappears at 20 feet as indicated by drilling behavior. Length Recovered 0.3 ft, Length Retained 0.3 ft		
20										

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06 10:26:43 A2

Washington State Department of Transportation

LOG OF TEST BORING

Start Card S-22888

HOLE No. TH-50-05

Sheet 2 of 2

Job No. OL-3420 SR 305 Elevation 31.8 ft (9.7 m)

Project SR-305 Widening Bond Road to Poulsbo Driller Thomas Harvey Lic# 2599

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7			12 18 20 (38)		D-8	GS MC AL	CL, M.C. = 25%, PI = 23 Lean CLAY, hard, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	8									
				25 50 (50/6")		D-9		Lean CLAY, hard, gray, moist, Homogeneous, HCl reaction not tested. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	9									
30								End of test hole boring at 29.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	10									
35										
	11									
	12									
40										
	13									
45										

SOIL OL-3420 SR 305 WIDENING BOND ROAD TO POULSBO.GPJ SOIL.GDT 2/6/06,10:26:44 A2

APPENDIX C - LABORATORY TESTING

LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program, including moisture contents, dry densities, grain size analyses and plasticity characteristics. The tests were done in general accordance with AASHTO guide specifications. The results of these tests are presented on the boring logs in Appendix A and in this appendix. After the testing was complete, the samples were classified in general accordance with the Unified Soil Classification System (USCS).

Job No. **OL-3420** Date **February 6, 2006**

Hole No. **TH-47-05** Sheet **1** of **1**

Project **SR-305 Widening Bond Road to Poulsbo**

Laboratory Summary

Washington State Department of Transportation

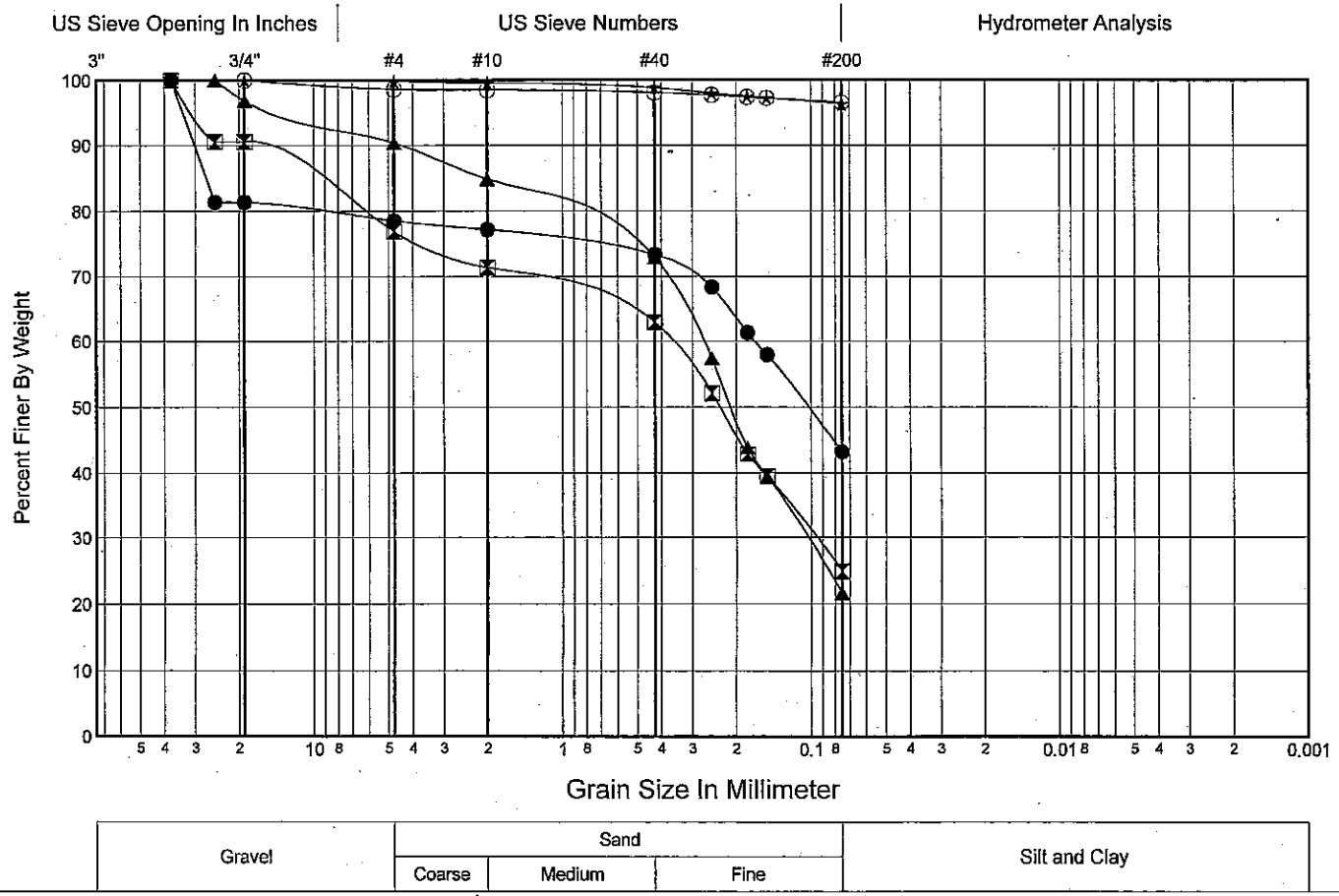
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	2.0	0.61	D-2	SM	See Boring Log	SILTY SAND with GRAVEL	20			
⊠	5.0	1.52	D-3	SM	See Boring Log	SILTY SAND with GRAVEL	13			
▲	10.0	3.05	D-5	SM	See Boring Log	SILTY SAND	15			
★	17.0	5.18	D-8	CL	See Boring Log	LEAN CLAY	22	48	24	24
⊙	25.0	7.62	D-10	CH	See Boring Log	FAT CLAY	24	50	25	25

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	21.5	35.3	43.2		
⊠	23.1	52.0	24.9		
▲	9.7	68.7	21.6		
★	0.2	3.5	96.3		
⊙	1.4	2.0	96.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.168	0.10			
⊠	0.369	0.23	0.10		
▲	0.274	0.21	0.10		
★					
⊙					



Job No. OL-3420 Date February 6, 2006

Hole No. TH-48-05 Sheet 1 of 1

Project SR-305 Widening Bond Road to Poulsbo

Laboratory Summary

Washington State Department of Transportation

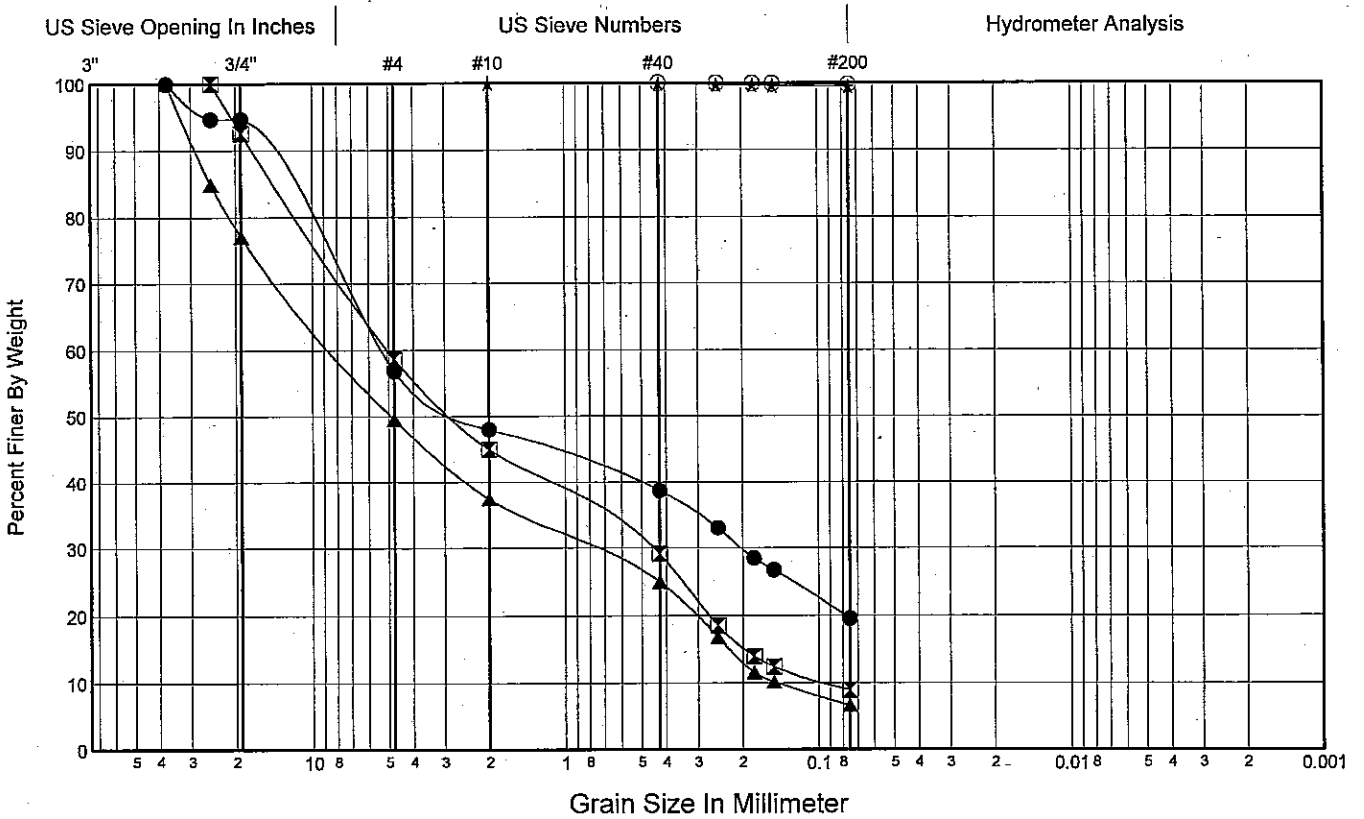
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	GM	See Boring Log	SILTY GRAVEL with SAND	12			
⊠	6.0	1.83	D-3	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	15			
▲	12.0	3.66	D-5	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND	11			
★	17.0	5.18	D-7	CH	See Boring Log	FAT CLAY	27	50	25	25
⊙	25.0	7.62	D-9	ML	See Boring Log	SILT	26	33	NP	NA

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	43.2	37.3	19.5		
⊠	41.4	49.7	9.0	0.5	54.3
▲	50.5	42.9	6.6	0.5	55.6
★	0.0	0.6	99.4		
⊙	0.0	0.2	99.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	5.342	2.44	0.20	0.08	
⊠	5.022	2.75	0.47	0.27	0.092
▲	8.075	4.87	0.80	0.31	0.145
★					
⊙					



Job No. OL-3420 Date February 6, 2006

Hole No. TH-49-05 Sheet 1 of 1

Project SR-305 Widening Bond Road to Poulsbo

Laboratory Summary

Washington State Department of Transportation

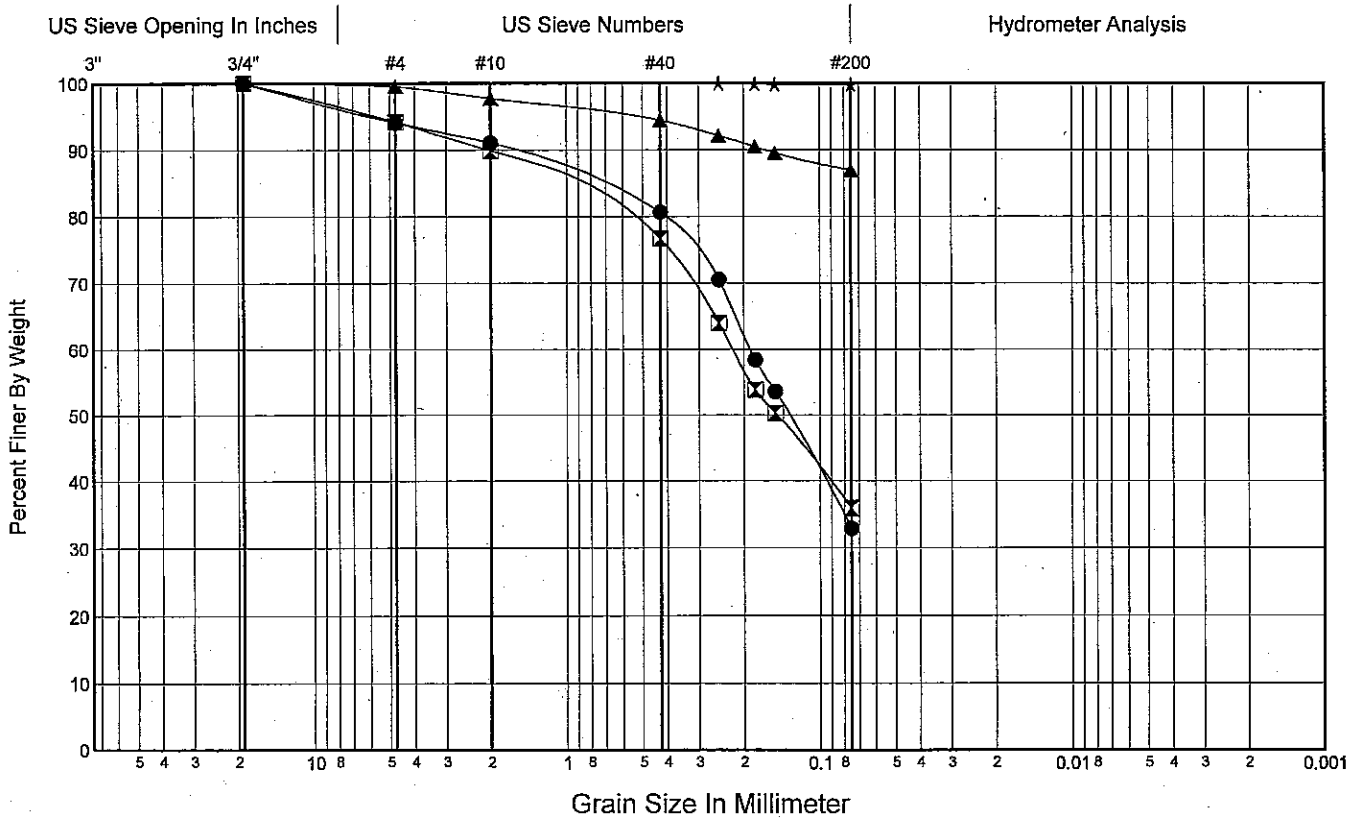
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	3.5	1.07	D-1	SM	See Boring Log	SILTY SAND	12			
⊠	11.0	3.35	D-4	SM	See Boring Log	SILTY SAND	12			
▲	16.0	4.88	D-6	ML	See Boring Log	SILT	22			
★	23.5	7.16	D-8	CH	See Boring Log	FAT CLAY	22	51	26	25

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	6.0	61.1	32.9		
⊠	5.8	58.2	35.9		
▲	0.5	12.6	86.9		
★	0.0	0.2	99.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.188	0.13			
⊠	0.220	0.15			
▲					
★					



Job No. **OL-3420** Date **February 6, 2006**

Hole No. **TH-50-05** Sheet **1** of **1**

Project **SR-305 Widening Bond Road to Poulsbo**

Laboratory Summary

Washington State Department of Transportation

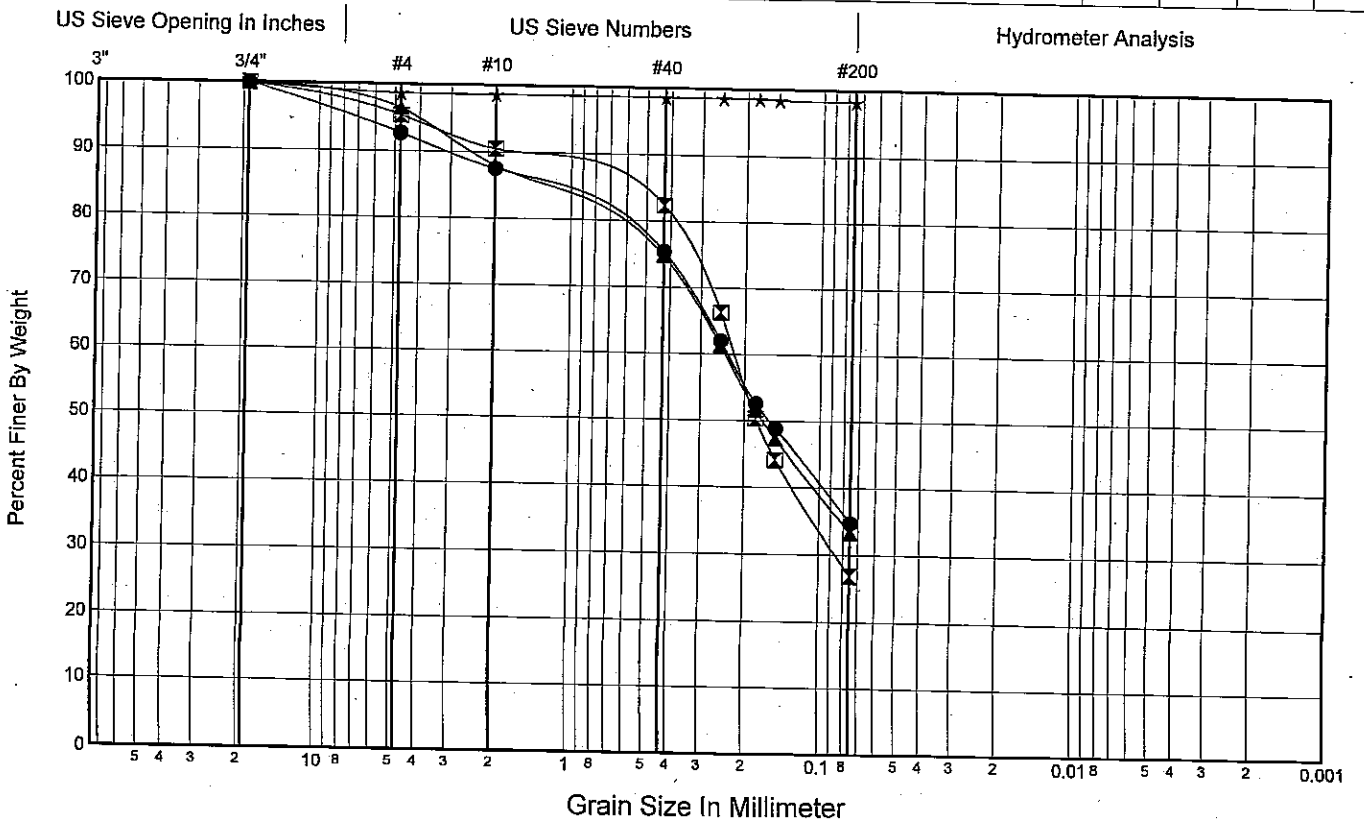
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	3.5	1.07	D-1	SM	See Boring Log	SILTY SAND	13			
⊠	6.0	1.83	D-2	SM	See Boring Log	SILTY SAND	12			
▲	13.5	4.11	D-5	SM	See Boring Log	SILTY SAND	12			
★	23.5	7.16	D-8	CL	See Boring Log	LEAN CLAY	25	49	26	23

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	7.3	58.0	34.7		
⊠	4.6	68.5	26.9		
▲	3.5	63.3	33.2		
★	1.4	0.4	98.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.233	0.16			
⊠	0.220	0.18	0.09		
▲	0.240	0.17			
★					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	